US Navy Tactical Fuels From Renewable Sources Program

9 May 2012

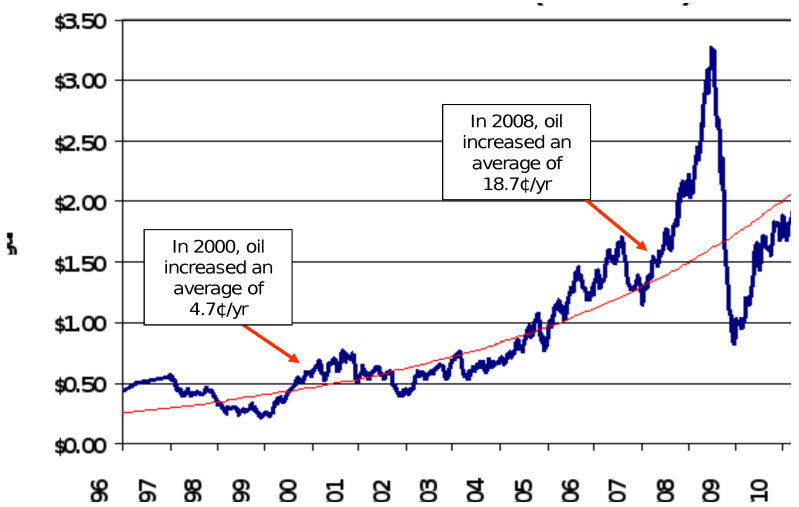
Prepared For: ECEC

Presented By: Rick

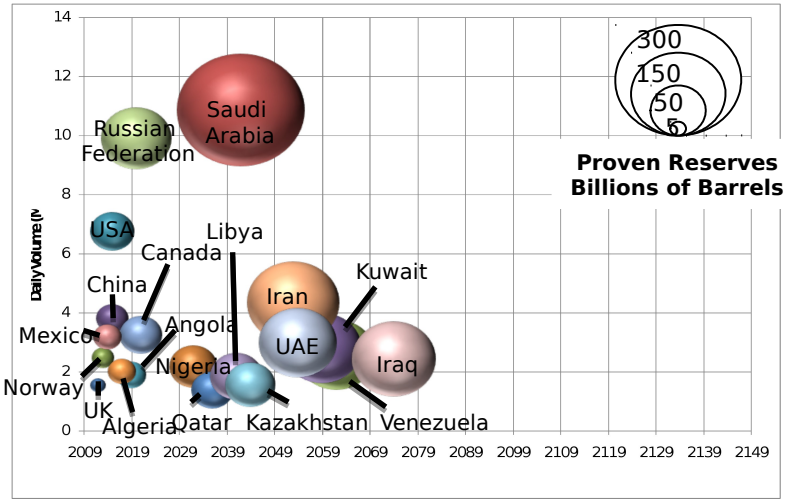
Navy Fuels Lead

Resource Challenge: Petroleum

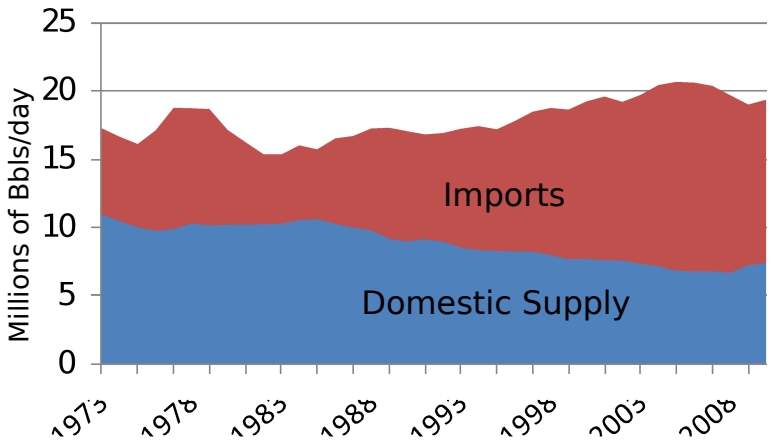
Price Volatility



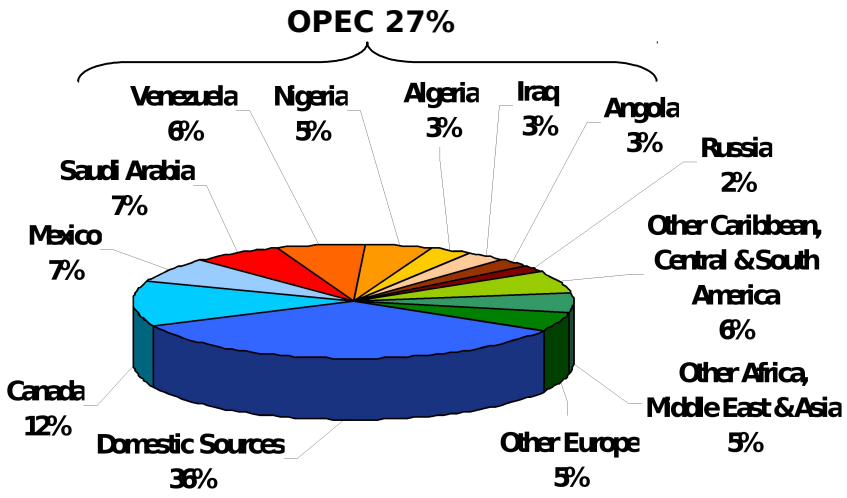
Oil Depletion Timeline (50% proven reserves



US Crude Oil Supply Trend

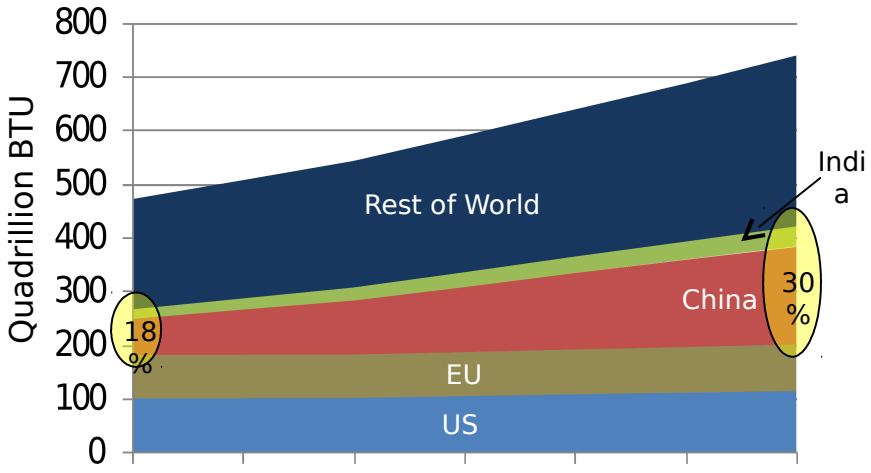


U.S Petroleum Supply (Avg. of 2006-2009)

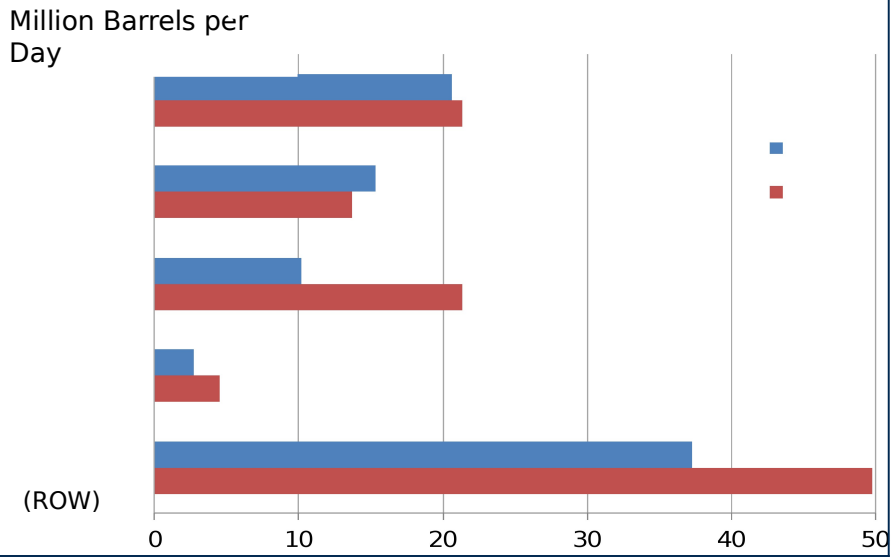


Evolving Energy Demands

Worldwide Total Energy Demand* (2005-2035)



Worldwide Liquid Fuel Consumption** (2007 & 2035)

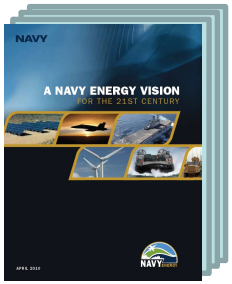


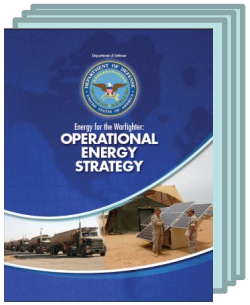
'Chindia' and ROW are becoming the global energy driver

* Source: EIA International Energy Outlook 2010
** Source: EIA, International Energy Statistics database (as of November 2009), web site www.eia.gov/emeu/international. 2035: EIA, World Energy Projection System Plus (2010)

Navy Energy Program

- **Drivers**
  - **Enhance combat capability**
  - **Reduce total ownership cost**
  - **Ensure energy security**
- **Strategies**
  - **Culture & behavior change**
  - **Retooling the existing fleet**
  - **Energy efficiency in acquisition**





"We need to be efficient with the energy that we have and that we need to find alternative fuels.

We are trying to use our fuel judiciously."

— Admiral Jonathan Greenert,

Navy Energy Goals

SECNAV Targets

Increased Alternatives Afloat 2020	**50% of total DON energy consumption from alternative sources**
Increased Alternatives Ashore 2020	**At least 50% of shore-based energy from alternative sources; 50% of installations net-zero**
Sail the "Great Green Fleet" 2012/2016	**Green Strike Group: local operations/sail**
Reduce Non-Tactical Vehicle Petroleum Use 2015	**Reduce petroleum use in commercial vehicle fleet by 50%**
Energy Efficiency Acquisition	**Evaluation of energy factors mandatory when awarding systems/buildings contracts**

CNO Targets

Reduce Consumption Afloat 2020	**Navy will increase efficiency and reduce consumption afloat by 15%**
Reduce Consumption on Ashore 2020	**Navy will increase efficiency and reduce consumption ashore by**
Protect Critical Infrastructure 2020	**critical infrastructure will have reliable backup/redundant power systems**

Alternative Fuels Strategy

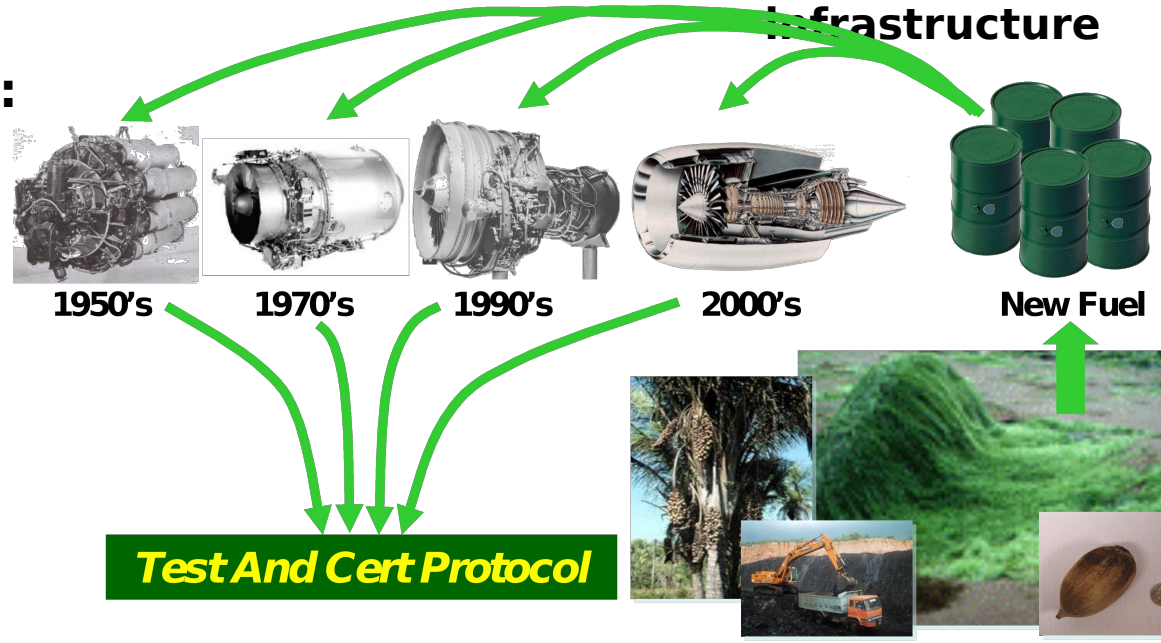
eets fuel performance requirements

n be mixed or alternated with petroleum fuel

- ✓ **Requires NO change to aircraft or ship**
- ✓ **Requires NO change to infrastructure**

Challenge:

Existing Systems



Not Changing the Fuel : Just its Source

Test Fuels

Derived from renewable sources

- Camelina and Algae based fuels used for Navy's testing

Refined

- Feedstocks are hydrotreated and hydrocracked
- Products are feedstock agnostic

Blended

- 50/50 blends meet all performance requirements of JP-5 & F-76 specs

Changed the source, not the fuel

Phase 1:

- Chemical And Physical Property Similarity
  - Specification
  - Fit For Purpose

Phase 2:

- Performance Similarity
  - Materials
  - Components
  - Propulsion/Fuel Systems
  - Distribution Systems

Phase 3:

- Operational Similarity
  - Weapon System Trials

Phase 4:

- Long Term Operability
  - Field Trials

The Green Hornet

F/A-18E/F Super Hornet

- U.S. Navy's premier fighter aircraft
- Operates at a wide range of airspeeds and altitudes
- Top Fuel Burner in The Fleet

Component Testing

- Auxiliary Power Unit Atomizer, Combustor, Engine Fuel Ctrl.

Engine Testing

- GE F414 Turbojet, GE F404 Turbojet, Honeywell 36-200 APU

Flight Testing

- Completed 16 flight tests for 17+ hours
- First-ever supersonic flight powered by a renewable jet fuel
- Extended Duration Flight Test in progress

No impacts to performance or operability

Green Hornet Flight Test
Earth Day 2010

Flight Testing

MH-60S Seahawk

- Extended service evaluation
- Algae HRJ5 blend testing

MV-22B Osprey

- Tilt-rotor, multi-purpose
- USAF/USN Coordinated Test

T-45A Goshawk

- Aircraft carrier-capable trainer

EA-6B Prowler

- Electronic Warfare

AV-8B Harrier

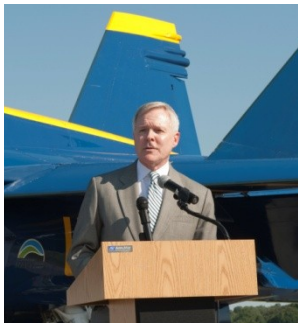
- Performance Hover Maneuvers

MQ-8B Fire Scout

- Unmanned Flight

No Operational Issues Noticed

Blue Angels



High performance maneuvers

Tight formations and close tolerances

No changes to performance

Blue Angel Biofuel Flight Sept 2011

HRD76 Platform Trials

7M RHIB

- Cummins QSB Engine

RCB-X

- Research Asset

YP Boat

- Extended Duration Trial

Self Defense Test Ship (ex DD Paul F. Foster)

- Gas Turbines (RR and GE)

LCAC

- Gas Turbines (Vericor)

Commercial Partnerships

- Extended Duration Trial
- Varying Blend Ratios (up to 100% Biofuel)

All Trials Showed No Impact to Hardware or Performance

FFG Operational Evaluation

FFG 54 (USS FORD)

- Operational FFG homeported in Everett, Washington
- Propulsion: 2 GE LM2500
- Lifted 25,000 gallons of HRD76 in February 2012
- Conducted routine operations on biofuel blend

- Ship's normal procedures were followed:
  - Fuel onload
  - Tank readings
  - Filtration
  - Sampling & Testing
  - Propulsion
- Ship's crew noticed no differences operating on the biofuel blend

2012 Green Fleet Demo

- RIMPAC – July 2012 (18 Countries Participating)
  - Refueling-at-Sea
  - Flight Operations
  - Surface Combatant Operations
- Fuel Source: 90% Waste Oil/10% Algae
- 700,000 Gallons F-76 50/50 Blend
  - Two Destroyers
  - One Cruiser
- 200,000 Gallons JP-5 50/50 BlendHRJ5
  - One Carrier (flight ops only)

Diversifying our Energy Resources

"As we make our next change – as we lead again in changing the way we power our ships and our aircraft, the naysayers who say it's too expensive, the technology is just not there – they are going to be proven wrong again because every time we've changed we've made us a better Navy."

— Mr. Ray Mabus, Secretary of the Navy

Questions ?

- Green Fleet web site: http://greenfleet.dodlive.mil/home/